

961714



# PATENT SPECIFICATION

DRAWINGS ATTACHED

961714

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**International Classification:**—H 02 f

## COMPLETE SPECIFICATION

### Improvements in Polarisation Indication Devices for Electrical Connectors

We, BELLING & LEE LIMITED, a British Company of Great Cambridge Road, Enfield, Middlesex, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to polarisation induction devices for electrical connectors, for example, two part electrical connectors of the multi-contact type; that is the multi-contact pin—multi-contact sleeve type.

Many forms of electrical connectors are known, in which an assembly of contact pins is engaged in an assembly of contact sleeves. The purpose of such connectors is to connect a plurality of electronic or electrical circuits or equipments to a further plurality of such circuits or equipment.

In a complex piece of electronic apparatus many such connectors are often required, and it is necessary to ensure that the correct assembly of contact pins is mated with its complimentary assembly of sleeves to avoid damage to the apparatus due to inadvertent incorrect mating.

It is usual to prevent such incorrect mating by providing a pin on either the contact pin or contact sleeve assembly, with a flat surface which pin can only enter a specified complimentary shaped aperture in the complimentary contact sleeve or contact pin assembly respectively. This system whilst effective, in avoiding wrong mating, is insufficiently visually indicative of the correct choice of assemblies for mating, and requires actually bringing together the assemblies to ascertain whether the correct choice has been made.

It is an object of the present invention to provide a simple polarisation indication device for an electrical two part connector of the multi-contact type, which indicates at a glance, the correct choice of one part of the connector to mate with the complementary part.

According to the present invention, there

[Price

is provided a polarisation indication device for an electrical two-part connector of the multi-contact type, which device includes a sleeve, and pin so mounted on a first and second part of the connector respectively, as to allow their positions to be varied with respect thereto, and at least one first spline and a complementary first notch, so associated with the sleeve and pin that for every position of the sleeve, with respect to said first part of the connector, the pin can only fully enter the sleeve to allow the two parts of the connector to mate with one another, when in a position with respect to the second part of the connector that allows the first spline and its complementary first notch to engage one within the other, and indicator means associated with said sleeve and pin to indicate said positions of sleeve and pin.

Preferably the connector is of the multi-contact pin and multi-contact sleeve type, in which case said first part of the connector is preferably a multi-contact sleeve assembly and said second part, a multi-contact pin assembly.

The first notch is preferably associated with the sleeve and the spline is on the pin. In a preferred version of this device according to this invention, the sleeve is embraced by an outer concentric sleeve formed with a second notch, the two sleeves being so associated as to enable their positions relative to one another, to be altered at will. In this embodiment the pin is concentrically embraced by a skirt formed with a second spline, which engages the second notch on the outer sleeve, this arrangement being such that only when each spline engages its notch can the two parts of the connector mate with one another.

The preferred version of the device of the invention, is particularly suitable for use in the two part electrical connector, such as is described in co-pending application No. 24869/58 (Serial No. 920,572). In such a connector, the two sleeve assembly is mounted

on the face of the clamping member. Each sleeve is formed with a bore, having aligned apertures therethrough to take a screw passing through the clamping member to the insulating support for the contact sleeves. Preferably the outer sleeve is formed with a part of exterior hexagonal cross section, which resides in a slot with opposed straight sides in the clamping member. Opposed sides of the flange are against said straight sides, thereby allowing for six positions of the outer sleeve with respect to said clamping member, which forms part of said part of the connector. Preferably also the aperture in the base of the outer sleeve is at least in part hexagonal, and a part of the other sleeve residing in this hexagonal part of the aperture is also hexagonal in cross section. This allows the other sleeve to assume six positions with respect to the outer sleeve. There are, in consequence, thirty-six different relative positions which the first and second notches of the sleeve assembly can assume. In the connector of co-pending application 24869/58 (Serial No. 920,572) the pin and skirt assembly are housed in a suitably shaped recess in a side wall of the contact pin assembly, so that when the respective splines and notches are properly disposed, the pin and skirt assembly can mate with the two part sleeve assembly to allow each contact pin, of the contact pin assembly of the connector, to mate with the appropriate contact sleeve of the contact sleeve assembly of the connector. The skirt is formed with an extension sleeve, terminating in a hexagonal head, whilst the pin is formed with a substantially identical hexagonal head, the arrangement being such that when the pin and skirt are assembled together adjacent end faces of the two hexagonal heads are in face to face contact, and forming a two part head also hexagonal in cross section. The recess in the side wall is such that the part in which the two part hexagonal head resides, has two opposed flat walls, against which opposed parallel sides of the two part hexagonal head abut. The two hexagonal heads making up the two part head, can be arranged in six different ways with respect to one another, whilst there are six ways to fit the two part hexagonal head in the flat walled part of the recess. Hence there are thirty-six different relative positions which the first and second splines of the pin and skirt assembly can assume, each corresponding to one of the thirty-six relative positions of the first and second notches of the sleeve assembly, to allow each contact pin of the contact pin assembly, to mate with the appropriate contact sleeve of the connector, according to co-pending application No. 24869/58 (Serial No. 920,572).

The indicating means includes a first indicated position, for example arrow, dot, line or the like on an exposed face of the first

part of the connector, and a plurality of second indicated positions, for example indicated by numerals, coloured lines, or areas, or the like, so spaced on an exposed end face of the sleeve or assembly, each of such second indicated positions being such as to be brought into a common orientation such as for example, substantial alignment with respect to said first indicated positions for every position of correct assembly which can be assumed by the sleeve or sleeve assembly, with respect to said first part of the connector. The indicating means also includes a third indicated position on the second part of the connector, for example an aperture in a wall of the cover of the second part of the connector, through which a part of exterior peripheral wall of the pin in the pin skirt assembly, can be seen, and a plurality of spaced fourth indicated positions, for example numerals, coloured lines or areas, or the like, on said exterior wall of the pin, each of said fourth indicated positions being such as to be brought into a common orientation, such as for example, alignment with said aforementioned aperture, with respect to said third indicated positions for every position of correct assembly which can be assumed by the pin or the pin-skirt assembly, with respect to said second part of the connector.

The invention will now be described with reference to the diagrammatic drawings accompanying the Provisional Specification in which,

Fig. 1 is an exploded perspective with one part of a polarisation indication device, according to an embodiment of the invention for use in the multi-contact pin part of a connector, according to co-pending application No's. 24869/58, 27929/60 (Serial Nos. 920,572 and 961,713).

Fig. 2 is an exploded perspective view of a complementary part of the polarisation device, according to said embodiment of the invention for use in the complementary multi-contact socket part of said connector.

Fig. 3 is an enlarged perspective view of one form of assembly of two items shown in Fig. 1.

Fig. 4 is an underneath view of the assembly of Fig. 3.

Fig. 5 is an enlarged perspective view of another form of assembly of the two items shown on Fig. 3.

Fig. 6 is an underneath view of the assembly of Fig. 5.

Fig. 7 is a fragmentary detail drawing showing the assembly of Figs. 3 to 6 fitted to another item of Fig. 1.

Fig. 8 is a side view of the detail of Fig. 7.

Fig. 9 is an enlarged perspective view of one form of assembly of two items shown in Fig. 2.

Fig. 10 is an underneath view of the assembly of Fig. 7.

Fig. 11 is an enlarged perspective view of another form of assembly, of the two items shown in Fig. 9.

Fig. 12 is a fragmentary detail drawing showing the assembly of Fig. 9 fitted to yet another item of Fig. 2.

Fig. 13 is a horizontal section through the line XI—XI in Fig. 12, and

Fig. 14 is a perspective view of a fragment of an assembled connector according to co-pending application No's 24869/58, 27929/60 (Serial Nos. 920,572 and 961,713), showing the mating of the assembly of items in Fig. 5 with that in Fig. 9.

Referring to the drawings in Fig. 1, an insulated casing 1, carries a row of plug pins 2, in an insulated support 3, which is a snap fit in casing 1. The casing has two side walls, one of which 4, houses a part 5, of a device for operating a clamping plate on the socket part of the connector, shown on exploded view in Fig. 2. This part 5, is described in co-pending application No. 27929/60 (Serial No. 961,713), and is not described in detail here. The other side wall 6, of the casing 1, has a compartment 7, housing a lead clamping cam 8. A threaded hole 9, is also in this wall 6, the bottom of which has a cavity 10, to accommodate the double hexagon head of the assemblies shown in Figs. 3 and 5. The opposed side walls 11, 12, of cavity 10, are flat and parallel to another, so that opposed flat faces of the double hexagon head seen in Figs. 3 and 5, abut, one against each side wall. Wall 12 is provided with a window 13 (Figs. 1 and 8), through which the face of double hexagon head abutting against wall 12, can be seen and numbers of said faces observed. The lower corner of casing 1, below cavity 10, is cut away as at 14, to accommodate the skirt part of the assemblies seen in Figs. 3 and 5, as in Fig. 7. The casing 1, is provided with a cover 15, with counter-sunk screw holes 16, 17, taking screws 18, 19. Hole 16 aligns with hole 9, and hole 17 with a second threaded hole 20, in the casing, so that the screws 18, 19, passing through the respective pairs of aligned holes, can hold the cover to the casing. Cover 15 has a further hole 21, which acts as a bearing for cam 8. A corner of the cover is cut away, as at 22, to correspond with the cut-away part 14 in the casing 1. The part of the polarising device of the present invention associated with the cover 1, consists of a pin 23, having a hexagon flange 24, just below its top end. This pin 23 has a first spline at its lower end. This pin can be associated with a sleeve consisting of an hexagonal head 26, connected by a shank 27 to a skirt 28. A bore 29 of keyhole cross section passes through the head and shank. By aligning the splined lower end of pin 23 in this bore, the pin can pass down the bore until its hexagonal flange 24, rests on top of hexagon head 26. The faces of the hexagonal

flange 24 are numbered 1 to 6 respectively, as are the faces of the head 26. The flange 24 is freely rotatable with respect to head 26, so that the position of first spline 25, can be altered with respect to a second spline 30 on the interior wall of skirt 28. This second spline 30, is seen endwise on in Figs. 4 and 6. The double hexagonal head formed in Figs. 3 and 5, by flange 24 and head 26, can only fit snugly between parallel walls 11 and 12 in side wall 6 of cover 1, when each flat face of flange 24 is in alignment with a flat face of head 26. There are thus only six orientations of spline 25 which permit the double hexagon head to fit snugly between walls 11 and 12. Likewise there are only six orientations of spline 30 which allows this snug fit to be achieved. The respective six orientations of splines 25 and 30 are seen in Fig. 4, one of each spline in full lines, and the rest in broken line. However, for every orientation of spline 30, spline 25 may occupy any one of its six orientations. For example when spline 30 is as shown in full line in Fig. 4, spline 25 can occupy any of the six positions shown simply by rotating flange 24 and keeping head 26 fixed in space. However, head 26 can be moved to occupy any one of six orientations when between walls 11 and 12 and in each orientation spline 30 occupies one of the six positions seen in Fig. 4. For each position of spline 30, spline 25 has a choice of six positions, so that there are in all thirty-six ways in which the skirt and pin assembly of Figs. 3 and 5 can be arranged and still allow to the double hexagonal head to fit snugly between walls 11 and 12 on Fig. 1. In each of these thirty-six ways the numbers on the flat faces of flange 24 will be associated with a different number on head 26. Hence, there are thirty-six different combinations of numbers which can be seen through window 13, each combination indicating one of thirty-six different orientations of splines 25 and 30 in space. Referring to Figs. 2, and 9 to 13, the multi-contact sleeve assembly complementary to the multi-contact pin assembly described above, consists of a support 31 accommodating contact sleeves 32, arranged to take one of each of pins 2. The mouth of each sleeve projects from the top face 33 of the support as in Fig. 2. Each sleeve is split and is capable of being closed about an inserted pin 2 by lateral movement of a clamping member 34 over face 33. This clamping member has keyhole shape slots 35, in which the mouths of sleeves 32 reside, this arrangement of clamping member slots and sleeves being the subject of co-pending application No. 24869/58 (Serial No. 920,572). The member 34 is moved laterally in accordance with the invention of co-pending application No. 27929/60 (Serial No. 961,713), by the complementary part of the device 5, which part includes a pin 36, passing through a bore 37

in support 31, a cam device 38, working in a slot 39 in member 34, and a nut 40, all of which are shown in exploded view in Fig. 2. In accordance with the present invention, the member 34 is provided at the end opposite slot 39, with a groove 41, having opposite straight sides 42, 43 this groove overlying an elliptical hole 44. The purpose of the latter is to allow unrestricted lateral movement of the member 34, to take place in the assembled connector. The hole 44 overlies a bore 45, and is itself surmounted by a mainly cylindrical outer sleeve 46, the bottom end 47 of which in Fig. 2 is of hexagonal cross section, both internally and externally. The sleeve 46 is slotted as at 48, so that the slot is symmetrical about a line drawn through the mid-point of one of the faces of the bottom end 47. The top face 49 of this sleeve has embossed therein numerals 1 to 6 inclusive, each number being at a point in alignment with a corner of the hexagonal cross section of end 47. Numerals 1 and 6 are on either side of the slot. The interior of sleeve 46, can accommodate as a sliding fit, a second and inner sleeve 50, of substantially analogous design to, and of the same length as sleeve 46. The bottom end 51 of sleeve 50 is again of hexagonal cross section. The sleeve is slotted at 52, in a manner similar to sleeve 46, and has numerals 1 to 6 inclusive on its top face 53, in positions analogous to the numerals on face 49. Sleeve 50 differs from sleeve 46, in that it has a bore 54 of circular cross section throughout its length. This bore is of smaller diameter through part 51, than through the rest of the sleeve, so that an internal shoulder exists. A long pin 55 can pass down bore 54 until its head 56 rests on this shoulder. The pin is of sufficient length to pass through sleeve 50, the thickness of member 34, and practically the depth of support 31. The bore 45 in the latter, is countersunk on its underside in Fig. 2 to take the nut 57 when this is screwed on the threaded end 58 of pin 55.

The inner sleeve 50 can be accommodated in six different ways inside sleeve 46, depending on how the part 51 of hexagonal cross section fits in the bore of hexagonal cross section in part 47, to give the configuration shown in Fig. 10. For any one position of slot 48 there are six positions which can be assumed by slot 52, namely between each pair of consecutive numbers on face 49. One position, namely between numbers 1 and 6, and in alignment with slot 48, is illustrated in full lines in Fig. 9 and the remaining positions in broken lines in this figure. Fig. 11 illustrates one of the alternative positions of slot 52 in full line. The assembly of sleeves shown in Figs. 9 to 13 can be accommodated in the groove 41 on clamping member 34 as in Fig. 12. When so assembled to member 34, two opposite sides of section 47 of sleeve

46 abut against walls 42, 43 of groove 41. An arrow 59 on the top face of member 34 (Figs. 2 and 12) points to the apex of the two outside end walls 60, 61 of groove 41. These intersecting walls are so arranged that a corner of the hexagonal cross section of part 47 of sleeve 46, fits snugly therein as seen from the section in Fig. 13. It will be clear that there are six ways in which sleeve 46 can be accommodated with a corner of part 47 fitting snugly in the intersection of walls 60, 61. This means that there are six possible orientations of slot 48 with respect to arrow 59. For each of these six orientations of slot 48, there are six alternative positions for slot 52. Hence the assembly of sleeves on member 34 allows thirty-six possible orientations in space and in each orientation a different combination of two numbers, one on face 49 and one on face 53 will be located directly above the tip of the arrow 59.

By arranging the numbers as shown in Figs. 7 and 8 and Fig. 9 to 12, it will be realised that only when the upper number showing through window 13 of the plug contact part of the connector is the same as the number of face 53 directly above, tip of arrow 59, can spline 25 be accommodated in slot 52, when the plug contact part of the connector is presented to the contact sleeve part. However, unless spline 30 can enter slot 48, the two parts of the connector cannot be mated. Spline 30 will only enter slot 48 when the number seen in bottom part of window 13 in Fig. 8 is the same as the number on face 49, directly above the tip of arrow 59 on member 34. Hence to make it possible for the two parts of the connector to mate, as in Fig. 14, it is necessary for the pair of numbers showing in window 13 of the contact pin part, to correspond precisely with pair of numbers showing directly above arrow 59 on the contact sleeve part of the connector. Thus when the connector has to be used for connecting up various permutations of circuits, each piece of circuitry connected to the plug, is allocated a pair of numbers (seen through window 13) on the plug part, and the corresponding piece of circuitry connected to the socket part is allocated the same pair of numbers as seen directly above arrow 59. This is done by pre-setting the various parts of the polarising device and assembling the device in the relevant manner. Therefore, unless the indicated pair of numbers on both parts of the connector are in correspondence, at least one spline on the plug part will foul a sleeve wall on the socket part, so that the two parts of the connector will not mate and wrong pieces of circuitry will not be interconnected. When the indicated pairs of numbers are in correspondence, each spline on the plug part of the polarising device will enter a slot on the socket part thereof, and proper mating of the two parts of the connector takes place. Since

there are thirty-six ways of arranging the two splines and thirty-six ways of arranging the two notches, thirty-six pieces of circuitry can be connected up with thirty-six complementary pieces without risk of making a wrong choice of plug and socket part.

#### WHAT WE CLAIM IS:—

1. A polarisation indication device for an electrical two-part connector of the multi-contact type, which device includes a sleeve, and pin so mounted on a first and second part of the connector respectively, as to allow their positions to be varied with respect thereto, and at least one first spline and a complementary first notch, so associated with the sleeve and pin that for every position of the sleeve, with respect to said first part of the connector, the pin can only fully enter the sleeve to allow the two parts of the connector to mate with one another, when in a position with respect to the second part of the connector that allows the first spline and its complementary first notch to engage one within the other, and indicator means associated with said sleeve and pin to indicate said positions of sleeve and pin.

2. A device as claimed in claim 1 and being of the multi-contact pin and multi-contact sleeve type, said first part of the connector being a multi-contact sleeve assembly and said second part, a multi-contact pin assembly.

3. A device as claimed in claim 1 or 2 in which the first notch is associated with the sleeve and the spline is on the pin.

4. A device as claimed in any of the preceding claims in which the sleeve is embraced by an outer concentric sleeve formed with second notch, the two sleeves being so associated as to enable their positions relative to one another, to be altered at will.

5. A device as claimed in claim 4 in which the pin is concentrically embraced by a skirt formed with a second spline, which engages the second notch on the outer sleeve, this arrangement being such that only when each spline engages its notch can the two parts of the connector mate with one another.

6. A device as claimed in any of the preceding claims and being a two-part electrical connector, such as is described in co-pending application No. 24869/58 Serial No. 920,572) the two sleeve assembly being mounted on the face of the clamping members and each sleeve being formed with a bore, having aligned apertures therethrough to take a screw passing through the clamping member to the insulating support for the contact sleeves.

7. A device as claimed in claim 6 in which the outer sleeve is formed with a part of exterior hexagonal cross section, which resides in a slot with opposed straight sides in the clamping member, opposed sides of the flange being against said straight sides, thereby

allowing for six positions of the outer sleeve with respect to said clamping member, which forms part of said first part of the connector.

8. A device as claimed in claim 6 or 7 in which the aperture on the base of the outer sleeve is at least in part hexagonal, and a part of the other sleeve residing in this hexagonal part of the aperture is also hexagonal in cross section, thereby allowing the other sleeve to assume six positions with respect to the outer sleeve to provide in consequence, thirty-six different relative positions which the first and second notches of the sleeve assembly can assume.

9. A device as claimed in any of the Claims 6 to 8 in which the pin and skirt assembly are housed in a suitably shaped recess in a side wall of the contact pin assembly, so that when the respective splines and notches are properly disposed, the pin and skirt assembly can mate with the two part sleeve assembly to allow each contact pin, of the contact pin assembly of the connector, to mate with the appropriate contact sleeve of the contact sleeve assembly of the connector.

10. A device as claimed in any of the claims 5 to 9 in which the skirt is formed with an extension sleeve, terminating in a hexagonal head, whilst the pin is formed with a substantially identical hexagonal head, the arrangement being such that when the pin and skirt are assembled together adjacent end faces of the two hexagonal heads are in face to face contact, and forming a two part head also hexagonal in cross section.

11. A device as claimed in claim 10 in which the recess in the side wall is such that the part in which the two part hexagonal head resides, has two opposed flat walls, against which opposed parallel sides of the two part hexagonal head abut thereby allowing the two hexagonal heads making up the two part head to be arranged in six different ways with respect to one another, which the six ways to fit the two part hexagonal head in the flat walled part of the recess, provides in consequence thirty-six different relative positions which the first and second splines of the pin and skirt assembly can assume, each corresponding to one of the thirty-six relative positions of the first and second notches of the sleeve assembly, to allow each contact pin of the contact pin assembly, to mate with the appropriate contact sleeve of the connector.

12. A device as claimed in any of the preceding claims in which the indicating means includes a first indicated position, on an exposed face of the first part of the connector, and a plurality of second indicated positions, so spaced on an exposed end face of the sleeve or assembly, each of such second indicated positions being such as to be brought into a common orientation with respect to said first indicated position for every position of correct

assembly which can be assumed by the sleeve or sleeve assembly, with respect to said first part of the connector.

- 5 13. A device as claimed in claim 12 in which said first and second indicated positions is constituted by an arrow, dot or line in the appropriate exposed faces.

- 10 14. A device as claimed in claim 12 or 13 in which the indicating means also includes a third indicated position on the second part of the connector, and a plurality of spaced fourth indicated positions, on said exterior wall of the pin, each of said fourth indicated positions being such as to be brought into a common orientation, with respect to said third indicated position for every position of correct assembly which can be assumed by the pin or the pin-skirt assembly, with respect to said second part of the connector.
- 15

15. A device as claimed in claim 14 in which the third indicated position is an aperture in a wall of the cover of the second part of the connector through which a part of the exterior peripheral wall of the pin in the pin-skirt assembly can be seen and a fourth indicated position is constituted by a numeral or coloured line or areas on said exterior wall of the pin.

16. A device as claimed in claim 1 and substantially as herein described with reference to the drawings accompanying the Provisional Specification.

For and on behalf of  
**BELLING & LEE LIMITED.**  
C. Russell Townend,  
Director & Secretary.

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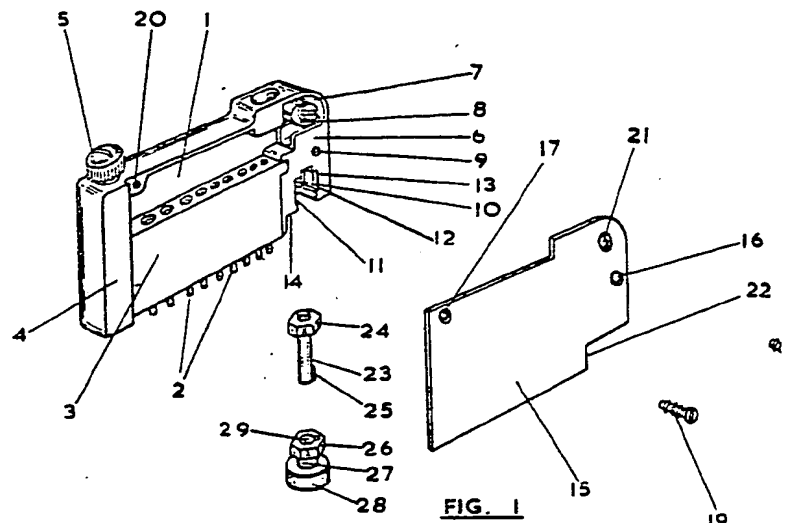


FIG. 1

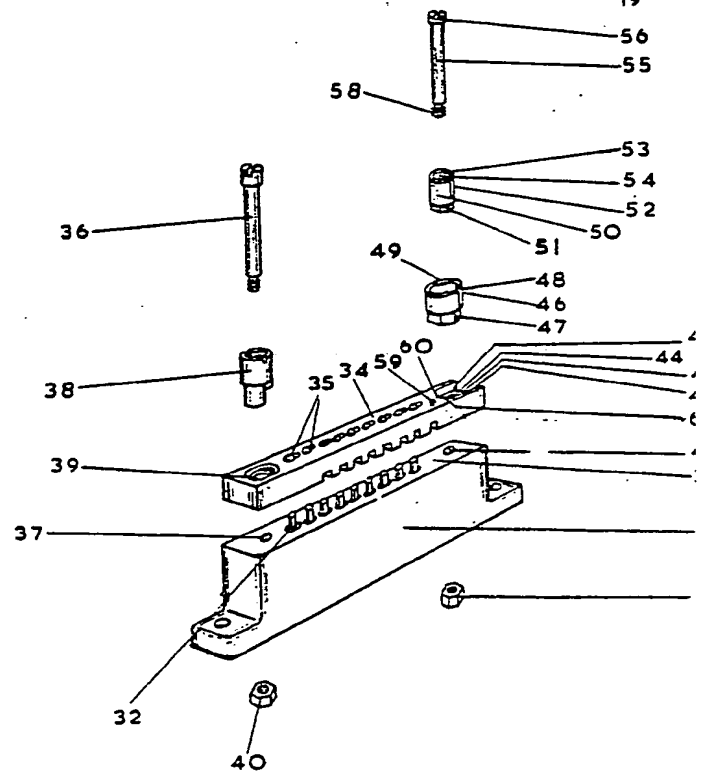


FIG. 2.

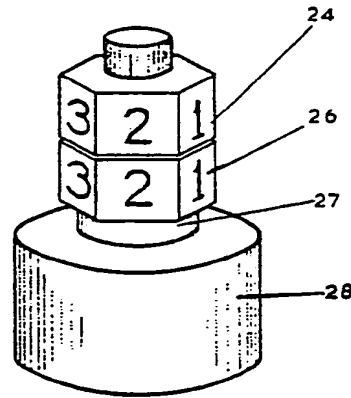
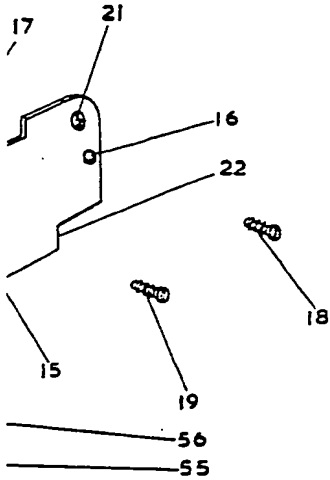


FIG. 3

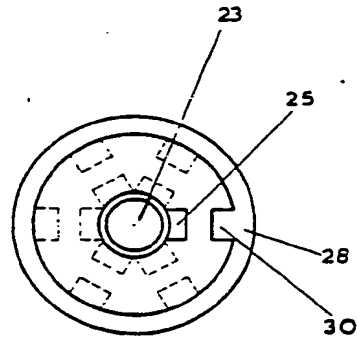


FIG. 4

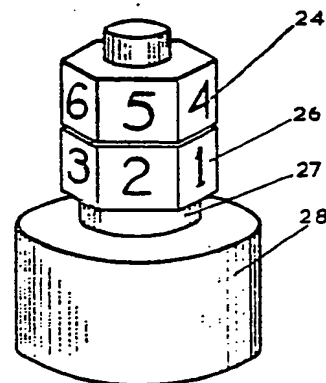
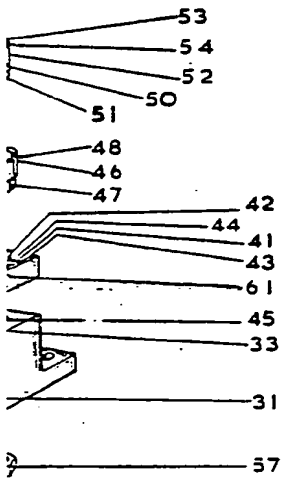


FIG. 5

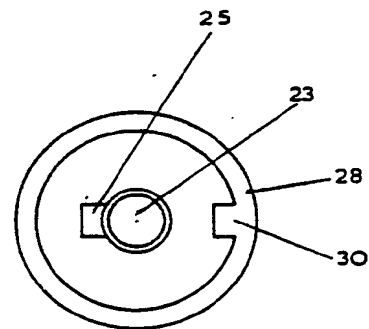
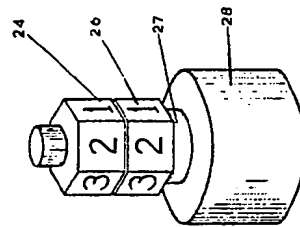
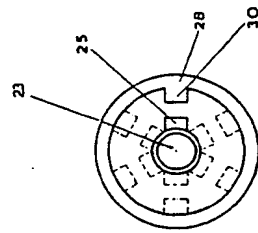


FIG. 6

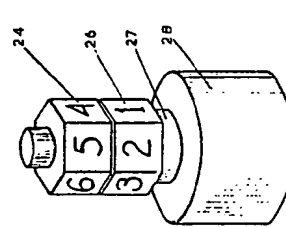
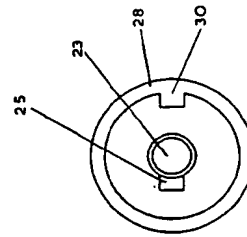




**FIG. 4**

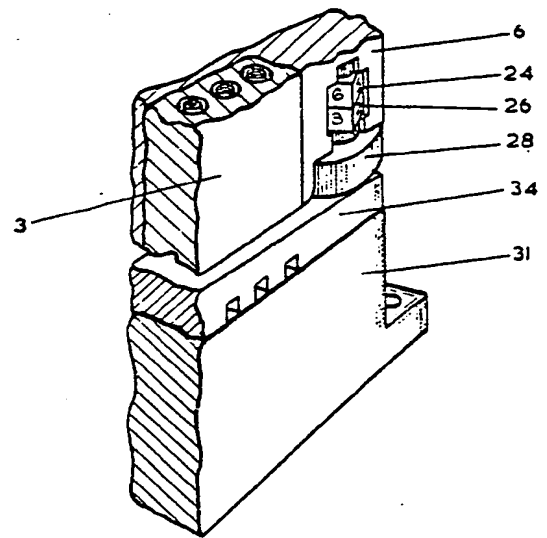
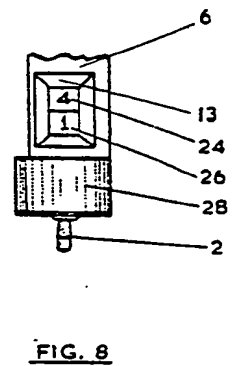
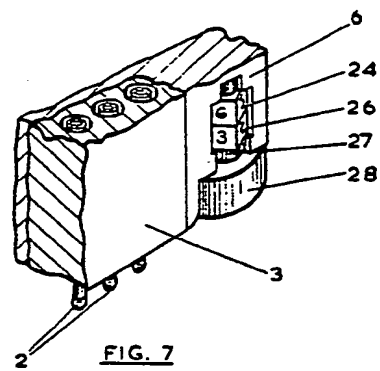


**FIG. 3**



**FIG. 6**





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 4 SHEETS *This drawing is a reproduction of  
 the Original on a reduced scale*  
 Sheets 3 & 4

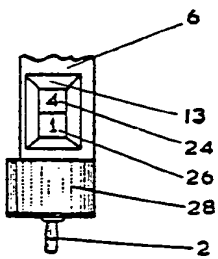


FIG. 8

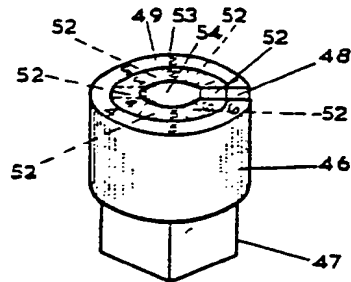
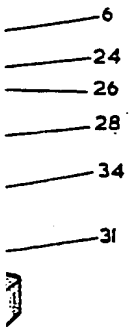


FIG. 9

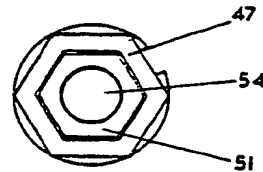


FIG. 10

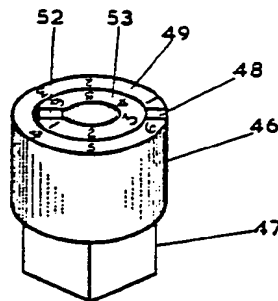


FIG. 11

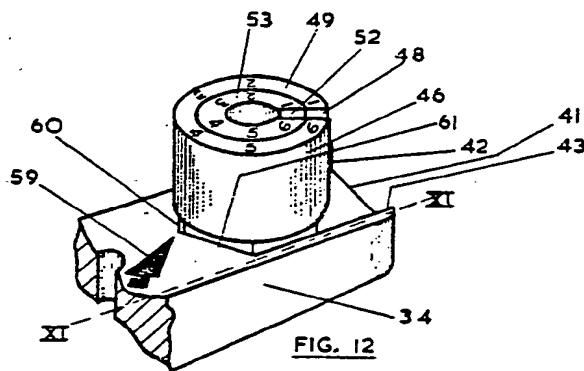


FIG. 12

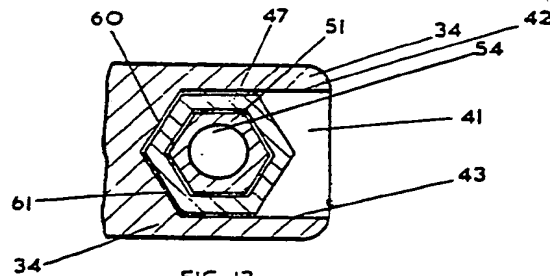


FIG. 13

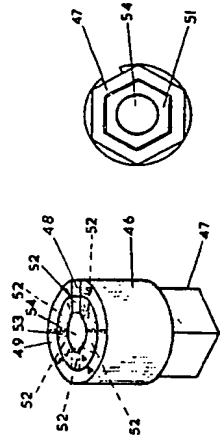


FIG. 9

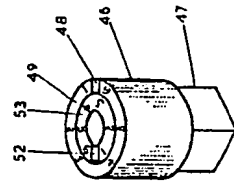


FIG. 10

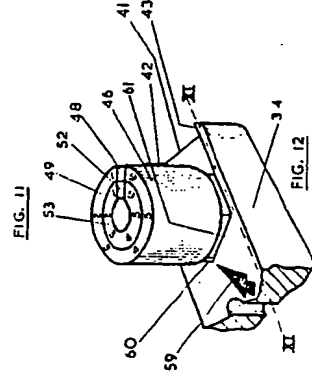


FIG. 11

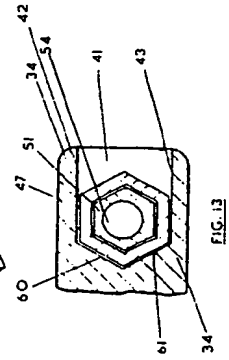


FIG. 12

FIG. 13

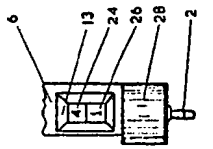


FIG. 8

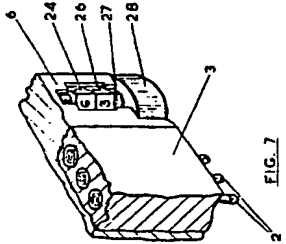


FIG. 7

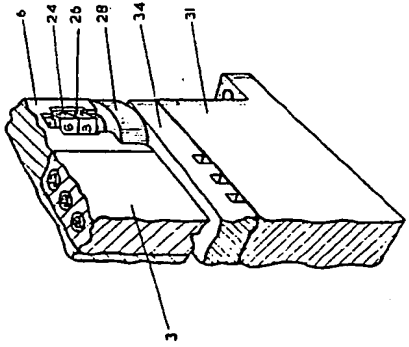


FIG. 14